

pump below F to the apparatus attached to M; but when the opening *p* is turned away from the groove the pump is cut off.

Suppose now that above *p* there is a vacuum, and that *p* is turned round so as to cut off the pump. Let the stopper at C be cautiously raised. Mercury flows from the cup C, and in the first place fills up the space below, and fresh mercury must be supplied to the cup and the supply kept up. The whole of the lower part of the space being filled, the mercury rises in the tube CB, lifts the glass float, and closes the opening *aa* with great pressure. To hold up the stopper at C during the flowing in of the mercury requires considerable force with an opening at C of an ordinary size; but as soon as the whole space from *aa* down to the bottom of D has been filled, the part of this force which is due to air pressure vanishes, and the stopper may be separated from C safely. The mercury in the tube AB does not drop out, as the orifice at *e* is very small; and thus there is nothing to prevent the apparatus under exhaustion being handled in any way that may be desired.

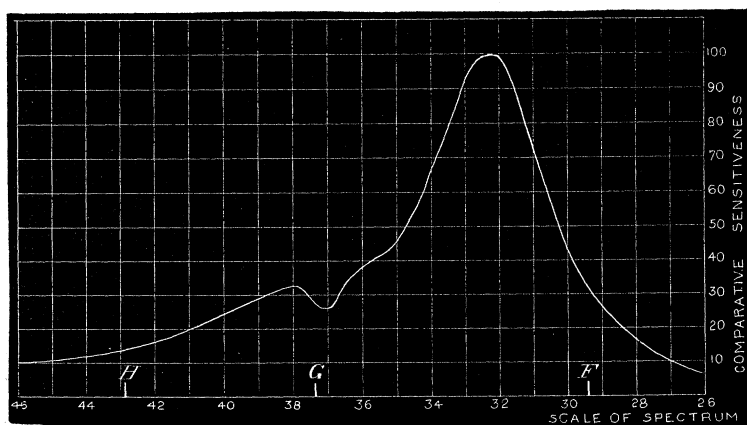
When the apparatus is to be reconnected with the pump, it is only necessary to replace the stopper in the cup C, and turn the hole *p* round to meet its groove. The mercury in the tube AB then drops into the pump. The float falls into its lowest position, and everything is once more as it was before the removal of the apparatus from the pump.

III. "Comparative Effects of different parts of the Spectrum on Silver Salts." By Captain W. de W. ABNEY, R.E., F.R.S. Received March 2, 1886.

In 1881 I communicated to the Royal Society ("Proc. Roy. Soc.," vol. 33) the results of a research I had made on the comparative effects of different parts of the spectrum on the haloid salts of silver, and I pointed out that a mixture of iodide and chloride, and iodide and bromide of silver gave rise to a very curious photographic spectrum, a minimum of action taking place at G, the point where the iodide is mostly affected, two maxima consequently occurring. I also gave some theoretical reasons why this should be. About a year afterwards Herr Schumann, of Leipzig, called in question this result, as applied to bromo-iodide of silver, when the two salts were formed simultaneously, *i.e.*, when mixtures in water of soluble bromides and iodides were precipitated together by silver nitrate. He subsequently found that a mixture of the two salts after separate precipitation did give rise to a double maximum. Now my own experiments showed that in either case such double maxima existed, but perhaps

they were more marked when the salts were precipitated separately. The only method at that time available to distinguish the maxima was by the appearance of a negative photograph of the spectrum impressed upon it, and hence there was a liability to be deceived, since densities in deposit which are nearly alike are apt to be overlooked.

I utilised my method ("Phil. Mag.," 1885) of obtaining patches of monochromatic light from the spectrum, in examining afresh different salts of silver as regards sensitiveness to different rays. The experiments were conducted in the following manner:—A sensitometer, designed by Mr. Spurge, was brought into use ("Photographic Journal," 1882, vol. vi). This consists of a series of small chambers, about 1 cm. square in section, and 2 cm. deep. Below these chambers is a sheet of brass, punctured as shown in the figure, each such puncture corresponding with the square chamber.



Numbers are also punctured in the brass triangle, to correspond to the order of intensity in which the light is admitted to each chamber. Below this brass plate can be placed a sensitive plate to be tested. The tops of the chambers are also closed by a brass plate, in which holes of different diameters are punctured. The area of each hole is $\frac{2}{3}$ that of the next, and the total number of chambers is 30. It will be thus seen that the difference in light from an equally illuminated surface admitted to the first and last holes is immense.

To obtain a surface equally illuminated two sheets of finely ground glass were used, one placed about one-eighth of an inch from the holes, and the other about a centimetre away from the first. It was found

that when the outside ground glass was illuminated by a candle about 3 feet away, the light shading every part of the bottom of each chamber was for all practical purposes uniform. A patch of monochromatic solar light from one part of the spectrum was then thrown on the ground glass, and an exposure of 30 seconds given to a plate in contact with the brass punctured plate at the bottom of the chambers. Another portion of the spectrum was next thrown on a fresh sensitive surface, and a similar operation carried out, and so on till the whole of the range of the spectrum had been utilised. In each set of experiments it is scarcely needful to remark the same batch of plates was employed. All the plates were developed together for the same length of time, and the number of the chamber noted where no photographic action was visible. Thus if No. 8 showed a trace of photographic action, and No. 9 showed none, No. 9 was taken as a measure. All these numbers were then tabulated, and the admitted light calculated.

Another series of experiments were then conducted precisely as before, the length of exposure being varied, and the numbers observed were again tabulated and compared with the first set. A third series was then taken, and a mean of the results taken. The plates were next fixed and the numbers read, and the light again calculated, with the result that the mean corresponded with the first mean. As a final check, each set of plates were printed on uniformly sensitised paper, and the gradations obtained by the method described in my *Treatise on Photography* (Longmans). The results obtained were almost identical with the first means. Various salts of silver and combinations of salts were tried, but I need only give one, which is that which has been disputed. The figure gives a graphic description of the results obtained. This series of plates was prepared with a mixture of 6 per cent. of iodide, and 94 per cent. of bromide of silver, and the two were precipitated together. It was somewhat difficult in a photograph of the spectrum, containing but little iodide, to be sure of this dip at G, owing to the occurrence of Fraunhofer lines. The method adopted brings the dip clearly into view. It might be thought that the strong band of lines near G produced it, but such is not the case, as pure bromide of silver without any admixture of iodide did not show it, and the one maximum of sensitiveness it had lay nearer G.

In the mixed salt which was experimented upon we thus still get two maxima, though the percentage of iodide and bromide is but small. The same line of argument which was applied in the paper I have already referred to as to the cause of this dip near G, still therefore applies.

Table of Intensities.

Scale No.	Intensity.
26	7·0
28	14·3
30	43·0
31	75·0
32	100·0
33	95·0
34	66·5
35	43·0
36	37·5
37	25·0
38	33·5
39	28·5
40	25·0
41	20·0
42	18·0
44	12·5
46	10·0

IV. "On the Properties of Matter in the Gaseous and Liquid States under various conditions of Temperature and Pressure." By the late THOMAS ANDREWS, M.D., LL.D., F.R.S. Communicated by the PRESIDENT. Received February 7, 1886.

(Abstract.)

The following are the general conclusions to which this inquiry has led:—

1. The law of gaseous mixtures, as enunciated by Dalton, is largely deviated from in the case of mixtures of nitrogen and carbonic acid at high pressures, and is probably only strictly true when applied to mixtures of gases in the so-called perfect state.

2. The critical point of temperature is lowered by admixture with a permanent gas.

3. When carbonic acid gas and nitrogen diffuse into each other at high pressures, the volume of the mixture is increased.

4. In a mixture of liquid carbonic acid and nitrogen at temperatures not greatly below the critical point, the liquid surface loses its curvature, and is effaced by the application of pressure alone, while at lower temperatures the nitrogen is absorbed in the ordinary way, and the curvature of the liquid surface is preserved so long as any portion of the gas is visible.

